



The effect of the introduction of an electronic booking system to appropriately prioritise gastroscopies at a regional hospital in South Africa

K Booyse,¹ MB ChB; O Swart,^{1,2} MB ChB, FCS (SA); J Gouws,¹ MB ChB; R Duvenage,^{1,2} MMed Chir

¹ Department of General Surgery, Worcester Provincial Hospital, Worcester, South Africa

² Ukwanda Centre for Rural Health, Stellenbosch University, Worcester, South Africa

Corresponding author: K Booyse (karien_booyse@yahoo.com)

Background. The National Institute for Health and Clinical Excellence (NICE) guidelines state that patients with dyspepsia as well as alarm symptoms, or those that are 55 years and older with new onset dyspepsia, urgently require an upper endoscopy within two weeks. The 'Be Clear on Cancer Campaign' launched by Public Health England estimated that 9% of deaths due to gastric and oesophageal cancers could have been avoided if the diagnosis was made at an earlier stage. Worcester Provincial Hospital (WPH) is a regional hospital in the Western Cape, South Africa, that due to resource constraints was unable to comply with these guidelines. An electronic endoscopy booking system was implemented in June 2014 to assist referring clinicians.

Objectives. To evaluate the ability of the booking system to appropriately prioritise and accommodate clinically appropriate patients for an urgent gastroscopy within 2 weeks at WPH.

Methods. Retrospective analysis of patients booked for urgent gastroscopies using the online booking system at WPH from July 2014 to June 2017.

Results. A total of 1 589 gastroscopies were performed, with 1 085 (65%) categorised as urgent by the booking system algorithm, during the study period. The median (interquartile range) waiting time for urgent gastroscopies was 19 (8 - 31) days and 437 (40%) patients underwent a gastroscopy within the recommended 2-week period. Of the patients undergoing gastroscopy within 2 weeks, 87 (20%) were diagnosed with upper gastrointestinal malignancies and 73 (17%) had significant benign pathology (stricture or ulcer). A total of 150 malignancies were diagnosed in the urgent patients of whom 87 (58%) were scoped within 2 weeks.

Conclusions. The volume of patients requiring urgent gastroscopy at WPH outstrips the available resources. The introduction of the online algorithm-based booking system was effective in prioritising patients. The use of this system facilitated a malignancy diagnosis rate which compares favourably with similar fast track endoscopy services in more developed countries.

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Gastric cancer is the fifth most commonly diagnosed cancer with the third highest mortality worldwide.^[1] The incidence of gastric cancer in South Africa (SA) is 3.4 per 100 000 persons annually. Oesophageal cancer is the seventh most common cancer worldwide and the eighth most common in SA. The incidence of the disease varies significantly around the world and is more common in men than women. In SA, the incidence of oesophageal cancer is 6.4 per 100 000 persons. Oesophageal and gastric cancer made up 3.2 and 5.7%, respectively, of the 18 078 957 newly diagnosed cases of cancer worldwide in 2018. Collectively gastric and oesophageal cancers accounted for 5 152 deaths in SA in 2018.^[1,2]

Diagnosis of oesophageal or gastric cancer is confirmed following a gastroscopy and tissue biopsy. Early diagnosis is critically important in achieving better survival rates and results in better patient outcomes. The 'Be Clear on Cancer Campaign' launched by Public Health England estimated 9% of deaths could have been avoided if the diagnosis was made at an earlier stage.^[3]

The symptom pattern in patients with early tumours is not distinctive; diagnosis is rarely possible on the basis of symptoms alone. People with oesophageal or gastric cancer may present with any of a variety of common symptoms such as indigestion, heartburn, reflux and epigastric pain or discomfort. Dyspepsia prompts a substantial proportion of primary care consultations, but less than

2% of patients with dyspepsia will have cancer. Advanced cancer may cause more specific symptoms such as dysphagia, odynophagia, weight loss, anaemia and vomiting.^[4]

Identifying the underlying cause of dyspepsia through clinical diagnosis alone is notoriously unreliable. A number of alarm symptoms have been identified to indicate patients at higher risk of serious disease. These alarm features are described in clinical guidelines as patients with dysphagia, or aged 55 years and older with weight loss, and any of the following: upper abdominal pain, reflux or dyspepsia.^[5] According to the National Institute for Health and Clinical Excellence (NICE) suspected cancer: recognition and referral guideline,^[5] patients with alarm symptoms require an urgent upper endoscopy to be performed within 2 weeks. Van Weel-Baumgarten *et al.*^[6] found that dyspeptic symptoms were not 'key symptoms' of gastric or oesophageal malignancy. Instead, the commonly accepted alarm symptoms were more useful predictors of malignancy. Complaints of dysphagia should be questioned, and a thorough evaluation of alarm symptoms helps to minimise unnecessary requests for gastroscopies.

Kapoor *et al.*^[7] demonstrated that fast track endoscopy referral, in which the referring physician designates a gastroscopy as urgent based on the presence of alarm symptoms, in patients with suspected upper gastrointestinal (GI) malignancy resulted in a significant

yield of cancer and serious benign disease (peptic ulceration, strictures, and severe oesophagitis) diagnoses. Furthermore, the application of narrower referral criteria reduced the number of inappropriate procedures while retaining high sensitivity for cancer. Notably, the fast track service had a cancer prevalence of 3.8% compared with a 1 - 2% cancer prevalence of the open access system – suggesting that fast track endoscopic services can double the detection of cancer.^[7]

However, this improved cancer detection rate within a 2-week period has not translated into a survival benefit. The ideal way to improve survival would be prompt detection of early cancer; unfortunately alarm symptoms usually signify advanced disease.^[8]

Worcester Hospital (WPH) is a rural, regional (secondary level) public hospital in the Western Cape, SA that services a population of ~800 000 people. WPH receives referrals from eight district hospitals (primary level) and several primary healthcare facilities. The endoscopic unit services the public health users (~80 - 84%) of the population. A 2008 audit of provincial gastroenterology services in the Western Cape showed that at least 60% of all adult endoscopies were undertaken at tertiary institutions and that the median (range) waiting time from consultation until gastroscopy was 9.25 (0.5 - 28) weeks.^[9]

An open access endoscopy booking system allows physicians and general practitioners to refer patients for endoscopy without prior outpatient consultation. The open access booking platform led to an increased demand for endoscopic procedures, which strained the available capacity. There were concerns regarding potential misuse of the system, leading to increased numbers of inappropriate referrals with normal outcomes. In the absence of clinically appropriate prioritisation of patients for gastroscopy, those requiring urgent services were being delayed, while patients not requiring urgent services were receiving attention unnecessarily soon. Referral guidelines are, therefore, crucial in ensuring the efficient utilisation of available resources by selecting patients in need of prioritised care.

WPH utilises a website (www.worcesterhospital.org), which was developed in house, to facilitate patient note-keeping for admission, procedures, operations and discharges as well the theatre and procedure booking lists.

Worcesterhospital.org developed a novel, smart phone enabled, fast track, electronic endoscopy booking system. This system was implemented in June 2014 to assist with the scheduling of endoscopies, prioritising requests as either urgent or non-urgent (Fig. 1). The booking system allows referring clinicians to select a clinical problem and follow an appropriate algorithm pathway, based on the alarm symptoms, for the specific clinical problem. The data entered automatically populate an endoscopy referral template and a request is submitted as either urgent (to be performed within 2 weeks) or non-

urgent (6 - 8 weeks). The implementation of this system has helped identify patients requiring urgent gastroscopy and, within the operational constraints, the WPH endoscopy service to try to perform these gastroscopies within the recommended 2-week period.

Objectives

To assess the compliance and efficacy of the online booking system in appropriately prioritising patients to urgent gastroscopy and to describe the proportion and findings of the patients undergoing gastroscopy within the 2-week time limit.

Endoscopy referral tool

Patient DOB Age years

Select ONE clinical problem or reason for endoscopy and follow the subsequent algorithm to determine the indication for and urgency of endoscopy:

- ☐ Dyspepsia including epigastric pain or heartburn/acid reflux with or without bloating and vomiting
- ☒ Suspected upper GI malignancy
- ☐ Unexplained iron deficiency anaemia without any other symptoms or signs
- ☐ Endoscopic surveillance in previously diagnosed conditions or recommended because of family history
- ☐ Suspected colorectal cancer or inflammatory bowel disease
- ☐ Colonoscopy surveillance in known inflammatory bowel disease or after polypectomy or colorectal cancer treatment
- ☐ Case has been discussed with a surgical consultant who advised endoscopy

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Clinical problem: Suspected upper GI malignancy

Suspected upper GI malignancy: Only the following are accepted indications for endoscopy:

- ☒ Progressive dysphagia
- ☒ Unexplained and unintentional weight loss
- ☒ Persistent vomiting
- ☐ Proven iron deficiency anaemia

↓

CLINICAL INFORMATION:	
Clinical problem:	Suspected upper GI malignancy: LOW + dysphagia
Is the patient on warfarin, and INR if so:	Not on warfarin
ASA Classification:	ASA I or II
Allergies:	No known allergies
Significant co-morbidities:	Healthy and no comorbidity
The indication for the requested investigation(s):	Suspected upper GI malignancy: Progressive dysphagia: URGENT < 2 week gastroscopy appointment on any list Unexplained and unintentional weight loss: URGENT < 2 weeks gastroscopy appointment any list Persistent vomiting: URGENT < 2 week gastroscopy appointment any list

Fig.1. Example of the online referral tool.

Methods

This is a retrospective review of a prospectively maintained gastroscopy database. Ethical approval was obtained from Stellenbosch University (ref. no. HREC #N16/10/139) for this study. All data were collected on the WPH's online fast track gastroscopy booking system between July 2014 and June 2017. Patient information was password protected with complete endoscopy information only available to the three surgery specialists. Unbooked emergency gastroscopies, planned interventional gastroscopies and follow-up gastroscopies at a specified interval were excluded from the study sample.

Malignancy was defined by histological confirmation of neoplasia on a biopsy. Significant benign pathology was defined as biopsy-proven non-neoplastic ulcers or strictures. Minor disease was noted as gastritis or duodenitis based on the visual appearance as noted by the endoscopist. A normal gastroscopy was defined as the absence of any pathology noted during the endoscopy. Urgent gastroscopy is defined as a gastroscopy that is required to occur within 2 weeks; these are identified by the presence of alarm symptoms, including progressive dysphagia, unexplained and unintentional weight loss, persistent vomiting and proven iron deficiency anaemia. Non-urgent gastroscopies could occur on the next available date.

Results

A total of 3 774 endoscopies, comprising 2 693 gastroscopies and 1 081 colonoscopies, were performed at WPH during the study period. The mean (range) age of patients who underwent urgent gastroscopies was 55 (11 - 94) years and 56% ($n=891$) of the patients were female. The online electronic booking algorithm identified 1 085 gastroscopies as urgent and 40% ($n=437$) of these received a gastroscopy within 20 weeks. This proportion cumulatively increased to 57 and 72% within 3 and 4 weeks, respectively, from request to endoscopy (Table 1). Overall, the median (interquartile range) waiting time was 19 (8 - 31) days (Fig. 2).

Of the patients classified as urgent ($n=437$) who received a gastroscopy within 2 weeks, 87 (20%) were diagnosed with an upper GI malignancy and 73 (17%) had significant benign pathology (stricture or ulcer) (Table 2). The gastroscopies identified as urgent ($n=1 085$) yielded a total of 150 malignancies, resulting in a malignancy detection rate of 13.8% (95% confidence interval (CI) 11.8 - 15.9%) of whom 87 (58%) were scoped within 2 weeks. Of

Table 1. Comparison of the waiting time of patients ($N=1 589$) before undergoing urgent and non-urgent gastroscopies at Worcester Hospital

Waiting time (weeks)	Urgent ($N=1 085$), n (%)	Non-urgent ($N=504$), n (%)
0 - 2	437 (40)	71 (14)
2 - 3	188 (17)	75 (15)
3 - 4	154 (15)	89 (18)
>4	306 (28)	269 (53)
Total	1 085 (68)	504 (32)

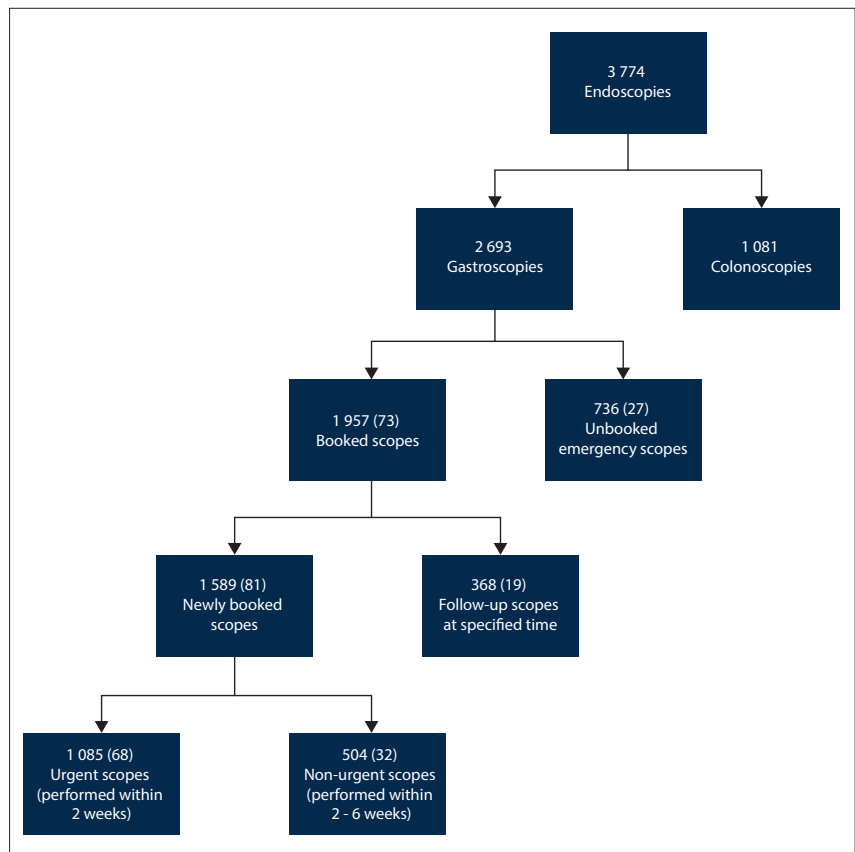


Fig. 2. Endoscopies performed at Worcester Hospital between June 2014 and July 2017 (n (%)).

the gastroscopies identified as non-urgent ($n=504$), 5 (1%) patients were diagnosed with malignancies.

Discussion

Endoscopy of the upper GI tract is a common procedure for the diagnosis of conditions such as peptic ulcer disease, gastro-oesophageal reflux disease or upper GI malignancies. It is the diagnostic procedure of choice in dyspepsia and, in many European countries, it is available on an open access basis.^[10,11] However, open access endoscopy policies have progressively increased gastroscopy demand, overloading endoscopic services and increasing waiting times for patients with significant pathology.^[12] Evaluation of the appropriateness and the diagnostic yield of an endoscopic service in relation to each clinical indication is essential to ensure appropriate resource allocation.

Guidelines from most professional GI bodies suggest early endoscopy (i.e. endoscopy as soon as is possible) in all individuals with dyspepsia over the age of 55 years and in all individuals with alarm symptoms.^[13] The NICE guidelines stipulate endoscopy within 2 weeks of referral for these 'high-risk' subjects.^[5] The findings in this study suggest that endoscopic services at WPH are unable to approach this standard of care as the need for urgent gastroscopy currently outstrips the available resources. This is reflected by the fact that only 40% of patients identified for urgent gastroscopy received one within the recommended 2-week time frame.

Our results suggest that the algorithm within the online booking system is effective in prioritising patients requiring urgent gastroscopy as evident by the low yield (1%) of malignancies diagnosed in the group categorised as non-urgent. The

Table 2. Pathology diagnosed in patients undergoing gastroscopy at Worcester Hospital

Diagnosis	Waiting period (weeks), n (%)							
	0 - 2		2 - 3		3 - 4		>4	
	Urgent	Non-urgent	Urgent	Non-urgent	Urgent	Non-urgent	Urgent	Non-urgent
Malignancy	87 (20)	3 (4)	23 (13)	1 (1)	17 (11)	1 (1)	22 (7)	0 (0)
Significant benign pathology: ulcer/stricture	73 (17)	5 (7)	21 (11)	8 (11)	21 (14)	5 (6)	38 (12)	19 (70)
Normal/minor disease: gastritis/duodenitis	277 (63)	61 (86)	143 (76)	67 (89)	116 (75)	84 (94)	246 (80)	250 (93)
Total, n	437	71	188	75	154	89	306	269
							1 085	504

overall cancer prevalence for the study period among patients referred to the fast track service and selected as urgent was 13.8%. The urgent gastroscopies performed within the 2-week time period yielded 20% malignancies and 17% significant benign pathology. Comparing the distribution of malignancies v. significant benign pathology v. minor or normal findings for all time periods, it is reassuring that more than half of the significant pathologies were diagnosed within the recommended 2-week time period. Similarly, the incidence of pathology decreased in the gastroscopies which were performed after the 2-week period. The results of this study warrant ongoing use of the online referral system. Moreover, it has emphasised the importance of appropriate referral behaviour at our referring hospitals, offering promise for the future of fast-tracking individuals with suspected malignancy or significant benign pathology. The worcesterhospital.org booking system has the potential to improve gastroscopy prioritisation at other state hospitals in the Western Cape and the rest of SA.

Despite positive initial findings, there is the potential that primary care doctors either under- or over-refer patients to fast track diagnostic services based on variation in their interpretation of symptoms and/or their knowledge of referral criteria. This is a limitation of the study. Furthermore, in the SA public healthcare setting there is substantial variation caused by socio-demographic factors, including patient access to transport, employment status and the ability to take time off from work to seek healthcare, ease of access to care, finance and level of education. In addition to these factors there are resource limitations, including bed, equipment and staff shortages, at WPH which make the overall endoscopy time frame difficult to determine. The influences of these factors on the 2-week guidelines need to be investigated further. Unfortunately, no comparison can be made between patients referred for fast track endoscopy and those previously referred on an open access basis at WPH due to the lack of quality data prior to the introduction of the booking system.

Several centres in the UK have presented initial data of their yield of malignancy in high-risk patients referred under the '2-week rule', reporting values of 4 to 15%.^[14,15] The numbers of patients referred per 6 months in these centres appears low (79 and 112, respectively) suggesting either poor local uptake of rapid assessment services or possible differences in local interpretation of the criteria laid down by the National Health Service (NHS) for the classification of urgent referrals.

Despite these limitations, the results from this study can form the basis for management to assist with improved strategic planning for this limited 'resource'. However, the booking service alone is not enough to improve the number of early diagnoses of GI cancers, and investment must

be made to educate healthcare providers in the primary care setting to understand and comply with referral recommendations. The referral recommendations will undoubtedly improve the journey for cancer sufferers although it is unclear whether this strategy will alter national mortality figures for upper GI malignancy. The latter is dependent on the stage of the malignancy when it is diagnosed, and efforts should focus on earlier diagnosis in order to improve patient outcomes. It is highly desirable to be able to provide rapid diagnosis for all cancer patients, irrespective of tumour stage or prognosis.

Achieving improved survival rates for upper GI cancer will require a multi-faceted approach involving various initiatives that include public education and targeted population screening. Few studies have established whether current strategies for detecting upper GI tumours are cost effective. Further research is needed to evaluate whether improving fast track evaluation of symptomatic patients is effective in improving patient outcomes at all.

Conclusion

The need for urgent gastroscopies (according to international criteria) outstrips the resources available at WPH. This study has shown the worcesterhospital.org online gastroscopy algorithm-based booking system was effective in prioritising patients with suspected upper GI malignancies. The system facilitated a malignancy diagnosis rate which compares favourably with similar fast track endoscopy services in more developed countries.

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Author contributions. KB analysed and interpreted the data and wrote the manuscript. JG wrote the initial research protocol and obtained the ethics clearance. OS revised the manuscript and provided guidance and input throughout the study. RD developed the worcesterhospital.org domain with its gastroscopy booking system and manages the database used for the study. All authors read and approved the final manuscript.

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